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ABSTRACT

The significance of design thinking and systems thinking for design has gained much recognition in recent years. In comparison to design thinking, scholarly discussion about systems thinking has a much longer history and includes more multiple and divergent perspectives. This paper reviews and critiques the essence of design thinking and systems thinking, and proposes a new approach for design, the design-within approach, to elaborate on the possibilities of fostering a design culture. Through design-within, learners could be engaged in envisioning learning, and in systemically designing their own learning. The design-within approach is an alternative approach that synthesizes the truly systemic spirit of systems thinking and the enlightening spirit of transformative design. Discussion includes the emergence of design thinking and its multiple perspectives; the link between design thinking and systems thinking; systems thinking and open educational systems design; the essence of Senge's systems thinking and its philosophical roots in both western and eastern culture; systems thinking as a language to be cultivated; comparison of Banathy's and Senge's systems thinking; and the design philosophy and roles of designers in the design-within approach. (Contains 25 references.) (AEF)

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Fostering Design Culture Through Cultivating the User-Designers' Design Thinking and Systems Thinking

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Cultivating design thinking and systems thinking for building a design culture

Since Cross (1990) claimed that design is a unique mode of culture, like science culture and humanities culture, the cultural aspect of design has received more and more attention in the design community. Banathy (1996) is probably the most well-known scholar who profoundly interprets Cross' thinking about design culture. He states that it is important to build a design culture through cultivating the general public's design competence and design literacy. However, I contend that we need to focus on ways of cultivating design thinking and systems thinking if we want to foster a design culture in the learning society. Because our thinking is constantly interacting with our action, which becomes the essence of our daily experience, and gradually shapes the forms and content of our culture.

Indeed, the significance of design thinking and systems thinking to design has gained much recognition in recent years. Tripp (1991), Rowland (1994), Akin (1994), Nelson (1994), Banathy (1996) have expended much efforts in analyzing and synthesizing design thinking and systems thinking since 1990. Compared to design thinking, scholarly discussion about systems thinking has a much longer history and includes more multiple and divergent perspectives. Some major systems theories have been successfully applied in organizational change, such as Senge's systems thinking, Checklend's soft systems methodology, Ackoff's design of idealized systems, and Nadler's planning and design approach. However, in this paper, I would focus on Banathy's and Senge's systems thinking. Meanwhile, I would propose an enlightening design approach, the DESIGN-WITHIN approach. This approach aims at enhancing both learners' inner revolution and societal learning revolution. Through design-within, we could engage learners and the learning community in envisioning their learning, and in systemically designing their own learning. Indeed, design thinking, as well as contemporary systems thinking are two wings to make us fly in the spacious learning world. The design-within approach is an alternative approach which synthesizes the truly systemic spirit of systems thinking and the enlightening spirit of transformative design.

The emergence of design thinking and its multiple perspectives

Design thinking is a historically well-developed discipline across many fields. However, in the field of instructional design, it has long been confined within strategic or systematic mode of thinking. Its rich essence is yet to be discovered. However, the following contemporary perspectives on design thinking have pointed out a much spacious world for instructional designers to explore.

Creativity and design

While clarifying the essence of instructional design and development, Davies (1981, 1994) attempts to uncover the multiple facets of it. The way he frames design in the craft, science, and art facets is very illuminating. He pinpoints the kinds of design and development possibilities from the "process" perspectives, and proposes a "process design" approach for corporate training. Rowland and Wilson (1994) look into the creative processes of design by exploring the essence of Csikszentmihalyi's flow psychology. They contend that to situate the designers in liminal states is critical to nurture their creative thinking. They enumerate several contexts that could trigger the designers' mental occurrence of liminal states. Most important, they depict design as the designerly ways of knowing, which is resonant with Banathy's interpreting design as a mode of inquiry. Meanwhile, Rowland (1993) investigates the design process of expert designers across many different design disciplines. By synthesizing the commonalities underpinning many design-related fields, he enriches our thinking about and understanding of the "design process".

Compatively speaking, the way Nelson (1994) approaches design is quite unique. He contends that design as learning is quite different from the traditional understanding of learning. He uses the concept of feedback for further explanation. He argues that "feedback in learning process is typically presented as positive or negative. Design learning involves another less known system's process that can best be characterized as feedforward; inquiry pulled by volition and purpose. It is not about discovering correct or incorrect predictions neither about describing reality in terms of truth. It is discovering knowledge at the edge between chaos and order; between the unknown and the known. Design learning is also pragmatic in the discovery and mastery of skills needed to bring about

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abstract concepts into lived reality (p.52)." Nelson (1994) advocates that we should have more patience to live with fuzziness of design and to undisciplined design. He also claims that design includes, but goes beyond, the theory of a science of the artificial in that it deals with the social organizations, patterns of human interactions, and functional social-technical structures that serve human purposes. Design is a synthesis of creativity (imagining new things) and innovation (bringing those new things into existence) within this multi-dimensional domain. It is both process and artifact. Compared to Davies and Rowland, Nelson seems to hold a more moderate stance.

Design as problem-solving vs problem-restructuring vs dialogical process

As an architecture design researcher, Akin has very different perspectives on problem solving and problem restructuring from many other researchers. He affirms that problem-restructuring is by no means a newly discovered phenomenon, but has a rather long history in design research and even historical discover on reasoning. We need to be aware that here Akin focuses much on "problem restructuring", rather than on problem-solving or problem framing. It is such problem-restructuring process that underlies design, and represents design as a unique profound discipline. We can say that the way Rowland situates designers in the liminal states for generating creative design is very similar to the way Akin emphasizes on engaging designers in the problem- restructuring process. Beyond our common-sense knowledge of problem-solving, Akin holds the views that the less understood a problem domain, the more the degrees of freedom the designer has and less reliance on standard solutions can be expected. Like Rowland (1994) and Banathy (1994) who believe that to design is to leap out from the present to the possible future, Akin thinks the process of creative design is to leap out of the framework to explore other possibilities or expand the boundary of the problem domain. Although Schon's research on professional practice is not limited to design-related fields, his thinking about problem solving has great implication on design. In fact, Schon (1985) is more pragmatic in terms that he values both problem-solving and problem-restructuring process. He regards problem solving and problem restructuring as the indispensable dual process, which provide us with the moderate way of knowing and action about design.

From these discussions, we could find that design thinking encompasses multiple perspectives. Instead of listing the various definitions of design, I would first synthesize Tripp's (1991) and Rowland's (1993) discussions about the design process and design nature, and then summarize Banathy's discussion about design nature and design culture in the following section. Tripp (1991) reviews numerous empirical studies of design across the general design field, such as engineering, architecture, software design. In probing the nature of design, Tripp tries to clarify if a theory of design can be constructed. Thus, he synthesized many divergent views of design into two general theories of design. According to Tripp, there are two different theories of design, namely design as optimization and design as dialogue. The former is in the same vein of Simon's perspectives (1981) whereas the latter is in aligning with Schon's (1987) reflection-in-action. They have various focuses. Design as optimization usually takes logical, rational, systematic processes. Yet, design as dialogue takes intuitive, creative, artistic processes. In terms of problem-solving in the design process, optimized design places emphasis on complete understanding prior to solution attempts in order to finding the best description of the problem. However, dialogical design takes early attempts at solution. Therefore, it is not like optimization design that treats design as an instance of problem solving. Instead, design is treated as a reflection-in- action process, and a social process of negotiation, hermeneutic in nature. In contrasting to optimization design's focus on formal representation of problem-heuristics activities, dialogical design usually embeds uncertainty, uniqueness and conflict.

From the above discussion, we could find that design has been inquired from various perspectives, which indeed range from design product (artifact), to design skills and strategies, to design process, and to design thinking. Rowland traces the process of design by finding out the converging arena of instructional design with design. He studies the relationships between design and instructional design from the 4 facets: the purposes or goal of design, relationships to other processes, factors that influence the design process, and the nature of design process. In addition to exploring the designers' creativity, and the design expertise, Rowland extends much of his scholarly discussion to the issue of nurturing the dialogical culture within the design community. This is very different from simply embedding the dialogical strategy to the design process. Indeed, Rowland and Wilson's conceptions of designerly ways of knowing and Rowland's discussions about design "culture" make design thinking the indispensable knowledge base of instructional design.

Design culture

While clarifying the nature of design, Banathy (1996) enumerates the various definitions of design from various design-related disciplines. He found that the various definitions of design convey the notion that design is practiced by many professions, in many different ways, and is applied in various contexts. When extending Cross' design as a mode of culture, he advocates that we should not leave design decisions affecting our society to the so-

called design experts. Instead, we should include a broad-based participation of the users in the design of their systems. We should build design cultures that include the general public in order to complement the expert culture of professional designers. However, if we want to include the general public in the design process, we need to cultivate the public's literacy in design. He affirmatively states that our era can surely be called the age of design. He suggests that in the age of design, the building of a design culture is an inescapable necessity. Because, if we take away design, we strip the world of most of its enabling mechanism. He urges the public to make choice for themselves, not simply relying on the experts' design thinking and decisions. Because we can either live with the poor design by the so-called experts, or we can empower ourselves by acquiring design literacy and design competence so that we can assume responsibility for the design of systems in which we live and to which we are connected.

Indeed, we should not be engaged in design simply to fix or complemement certain aspects of the whole learning environment. What we need is to create a new image which is more encompassing than the original one through reflective, critical and enlightened thinking. We also need to cultivate the designers', user-designers' or the design community's critical awareness of their beliefs and values that underlying their design thinking and action. Like the way Senge clarifies unwhished vision and wanted vision, Banathy makes clear difference between improvement and restructuring. Through such clarification and distinguishment, we could better understand that design is a unique mode of thinking, not an add-on to any other disciplines. In particular, Page's (1966) "design as an imaginative jump from present facts to future possibilities" seems to provide a clear direction for designers to strive for. But, here emerge some fundamental questions:

- How could we transform the current reality by design?
- Do we need any other disciplines than design to attain such transformation?
- While trying to generate the design image of the new reality, how should we cope with our own habitual design thinking and action, which is so deeply ingrained in our mental models?
- How would users and designers interact in the design culture?

Link between design thinking and systems thinking

Although design thinking and systems thinking seem to be literally different, they are two interrelated concepts when applied in learning or instructional design. When dealing with design issues, instructional designers inevitably face the complicated learning or educational systems. Indeed, design is a powerful bridge to integrate systems thinking into learning or instructional practice. This is why Banathy (1996) highlights systems thinking as the conceptual environment or parent of design thinking. He regards that design is one of several disciplined inquiry domains of social systems in which systems thinking is manifested.

Banathy's intellectual technology—"designing" social "systems"

Indeed, Banathy has been engaging himself in the design inquiry since the 1960s. While he is well known as an enthusiast for systemic design of educational systems, his efforts in advocating design literacy and culture is less well known. Part of the reason may be because of the complexity and profundity of his design thinking. In "Designing social systems in a changing world", Banathy (1996) endeavors in historical and extensive scholarly discussion on design. He compares design and other modes of inquiry, and treats design as one of the three cultures, science, humanities and design. Furthermore, he tries to envision the new social systems by regenerating design, trying to bring design to the social system, the educational contexts, and everyone's life. His design thinking is closely linked to his systems thinking. In another words, his design thinking is to be realized and carried out in the open social systems. We can say that he has depicted a spacious and magnificent landscape for the designers to travel.

Banathy advocates that we need creative and proactive design visions to transform the social, educational reality. He not only defines design and social systems, but also comprehensively compares design and other modes of inquiry, and approaches design from the cultural visions. He defines design as a multidimensional inquiry by synthesizing systems thinking, design thinking and other multiple perspectives. He also tackles the ethics of social system design and the design of the ideal system. In essence, he integrates a wide range of knowledge in approaching his inquiry of design. His contribution to design inquiry is that he elegantly and profoundly synthesizes design thinking and systems thinking.

Nelson's designers as symbolic synthesizers

While Banathy conceptualizes social systems design as intellectual technology, and integrate systems thinking in his social systems design inquiry, Nelson cautiously probes the reasons for engaging in systems design. He claims that we need to know about why systems design is in need for the new age, and contemplates that system

designers as symbolic "synthesists", whose role is inclusive of what a symbolic analyst does, is an emerging significant role for a complex world, working in environments of complexity.

He asserts that new times need new designs. Therefore, learning systems design should involve the synthesis of two very important intellectual traditions which are gaining prominence with the establishment of the information age: systems thinking and design action. He further explains that systems thinking provides a framework for describing or conceptualizing the complexity, interconnectedness, and nonlinear dynamics of institutional and organizational systems, while design provides the action framework for how to visualize and bring into existence, in functional form, telelogic systems (i.e., serving human purpose). Of the two, systems thinking is the most developed theoretically. Design is the most developed pragmatically but is in need of the most development conceptually in order to more fully enhance the synergistic potential in combination with existing systems thinking.

Nelson's (1994) thinking about design is special in three aspects: First, he argues that problem solving and design are entirely two different phenomenons. Design is a special way of thinking-different from scientific thinking-that is performed "out of control", with a deliberate break from restrictions on imagination. Second, in defining design, he distinguishes between self-expression of the arts and other expression of design. He describes the relationship between designer (self) and the client (other) as synergistic, as becoming more capable of more than the client or designer separately. Third, like Banathy, he links systems thinking to design thinking, and argues that we need to move away from thinking in separate disciplines of expertise. He offers the integration of systems and design as a powerful perspective for meeting current organizational challenges.

Systems thinking as another wing to take us to the spacious learning world

Systems thinking has played a critical role in the historical development of educational technology since 1970s. The instructional design models which adopt systems thinking were once widely recognized in many educational and training contexts. Despite the positive recognition of its value to education and training, the essence systems thinking is narrowed down to "systematic" view, distorted its true spirit greatly. While constructive learning and situated learning gain more and more attention in the area of instructional design, the way systems thinking has been interpreted and applied is also challenged. Although some scholars turn to systemic views to broaden their perspectives on systems thinking, its essence has yet been thoroughly studied. I believe that deeper understanding and discussion about various modes of systems thinking is essential for uncovering the potential significance of systems thinking in terms of fostering design culture. At the fundamental level, cultivating user-designers' systems thinking for design is more important than developing more systematic or systemic models for them to use.

Therefore, in addition to reviewing, analyzing and comparing the design thinking mentioned above, I would focus on Banathy's and Senge's systems thinking. Because Banathy not only synthesizes and critically reviews many system philosophers' systems thinking, but also integrates successfully systems thinking into his design inquiry. He integrates a wide range of knowledge of design thinking and systems thinking when undertaking his design inquiry to transform the social systems. His contribution to design inquiry is that he elegantly and profoundly synthesizes design thinking and systems thinking by pointing out the route to transforming the existing educational systems into the ideal creative system. Senge's systems thinking, as he refers to as the fifth discipline, is embodied in and interacting with other disciplines (i.e. personal mastery, shared vision, team learning & mental model) to help a team or organization to cultivate their learning culture. His systems thinking and other disciplines to be practiced with systems thinking has been widely recognized in restructuring organizational learning culture. In the past two years, he and several other researchers and practitioners also develop organizational learning through the five disciplines in the educational contexts. Therefore, his systems thinking as well as other disciplines has great implications on fostering an organization's learning culture.

Systems thinking and open educational systems design

Banathy's visions of systems thinking underwent great change in the 1970s. Earlier than that, he regarded instructional systems as close systems to be well thought and designed like many instructional technologists. In the book "Instructional Systems", he was still confined within closed systems engineering type of thinking to construct the instructional systems. Even so, the instructional systems he proposed is much more systemic compared to many instructional design and development models in the 1970s and 1980s. Yet he believes that as long as the instructional systems are closed, they are useless in the domain of social systems, and even counter the spirit of learning and education. Therefore, he proposes an open-systems view to deal with the educational problems, and published "Developing a systems view of education: A systems models approach in 1973. In the past 2 decades, he has been advocating his design thinking and systems thinking to designing social systems. He attempts to diffuse systems thinking and the dynamism of it to the educational community. In 1996, he finished his system design

theory, which encompasses 3 models for redesign the educational system, i.e. a system-environment model, a functions/structure model and a process model. The three models are to be applied in two aspects: First, they are to depict the systems concepts and the systemic level of the way we understand the educational structure of the existing systems, and the way we evaluate the educational environment. Second, they are used to design the new educational systems by comparing the gap between the ideal conceptual systems and the existing systems. He not only designed the 3 models but also provide many activates to guide the users to apply his models, through which users might gradually cultivate their systems thinking and systems application capabilities. In terms of this, Banathy seems to be much closer to Senge, both of whom do not intend to merely invent models and theories for users and learners to apply, but engage them in the thinking process and problem-solving processes. Unlike many instructional technologist who make much efforts on constructing design models and theories, Banathy claims that more efforts should be expended to cultivate the instructional technologists systems thinking, and their literacy of systems theories and systems methodology, which he has been persistently working on.

In referring to Stafford Beer's vision that human beings are prisoned by their own thinking, Banathy tries to construct his systems models to expand our cognitive power, and enhance our capabilities to deal with complexity. He found that traditional science defines complexity by examining the multiple components within a system, whereas systems science defines complexity by the interaction between the system and its environment, and by the relationship among the components within the system. What makes a difference is that the former is a close, static system, but the latter is an open, dynamic system. It is essential to recognize that Banathy's systems thinking is to be applied in the open social systems, and closely linked to the concepts of synthesis and expansion, rather than analysis, which underlies most traditional instructional design and development models. He argues that through synthesis and expansion we can better understand the systems and its relationship with the larger systems or environments. Meanwhile, we should shift from anticipating, predicting and controlling the human world to understanding the uncertainty and complexity of the environment.

However, while applying Banathy's systems models to designing educational systems, we need to reflect upon how our habitual thinking, acting and problem-solving patterns might counter the new design thinking or systems thinking. Because no matter how sounding the systems methodology or models are, human thinking and acting tend to follow their habitual routes, rather than new, less traveled routes. Especially when the user-designers are engaged in team work, such reflection on the gap between their old and new thinking is even more important. Because everyone's understanding and acting upon the system methodology and models may diverge at different levels and dimensions. Therefore, how to cultivate all design participants to use design language or system language at a more communicable platform becomes a fundamental, significant issue. If users or learners do not have full understanding and communication of the visions of the ideal systems, or could not form a design team, they might add another dimension of complexity to the system itself. Indeed, the human factors which interfere with or even fail many restructuring tasks in education are not uncommon at all.

From Banathy's systems thinking, we have a much broader view of what systems are and how systems thinking might be applied to solve the existing problems or design new educational systems. Such systemic perspectives do help expand our cognitive power about systems and reconceptualize our rigid understanding of instructional or educational systems. However, as mentioned earlier, the user-designers or learners should be provided with ample opportunities to reflect upon their habitual thinking and acting which might have interfered with their engagment in systems thinking or even prevented them from understanding the new mode of thinking. Because transforming one's inner habitual thinking, acting and ways of design may be more difficult than redefining and clarifying the system problems, or generating strategies to create the ideal systems. To overcome this, we could gain much insights from Senge's systems thinking.

If we could undertake the task of design from alternative perspectives, we might be able to shift design focus from designing learning product and environments to cultivating their thinking and actions about design. Below, I will analyze and critique Senge's systems thinking, and its practice with other disciplines for regenerating a learning organization.

The essence of Senge's systems thinking: Philosophical roots in both western and eastern culture

Senge's systems thinking has profound philosophical roots in both western and eastern cultural traditions. While developing his systems thinking, he converges much ancient Chinese wisdom with traditional western philosophies, and, furthermore, integrates them into the theory of systems dynamics. If we interpret Senge's systems thinking without recognizing its profound philosophical roots, we may not be able to capture the wholeness of his systems thinking. Through critically reviewing the essence of Senge's systems thinking, I found that his systems thinking is framed from views of learning, time and space, cause and effect, universe, structure, and working ethics. He argues that "learning" has lost its central meaning in contemporary usage, because learning has come to be synonymous with "taking in information." Yet, taking in information is only distantly related to real

learning. Learning should involve a fundamental shift or movement of mind. Real learning gets to the heart of what it means to be human. It is through such learning that we re-create ourselves. In other words, true learning should be transformation of spirit and mind, not merely accumulation of information or knowledge. Furthermore, he proposes that we need to transform the technical mode of working into the spiritual pursuit of working ethics.

Senge also thinks that our distorted views of time and space often destroy our patience because we can easily encounter a current problem, which is indeed resulted from yesterday's solution. The relationship between cause and effect is not closely related in time and space as we always imagine and expect. Very often our impatience and intolerance with the effect makes us rush into erroneous judgment or decision-making, which is even worse than no judgment or decision at all. His perspectives on universe distinguishes him from other systems thinkers greatly. He does not define the components of systems or categorize the types of systems, but emphasizes that the line between inside and outside, parts and wholes is indeed very arbitrary. Because we tend to treat problems as if we are outsiders, rather than treating the problems and ourselves as oneness, we often unconsciously complicate the nature of the problems. Based on these philosophical thinking and perspectives, he develops several laws of systems thinking, such as "Today's problems come from yesterday's solutions.", "The harder you push, the harder the system pushes back.", "The cure can be worse than the disease."

Systems thinking as a thinking language to be cultivated

Like many other systems thinkers, such as Banathy and Checklend, Senge's systems thinking is also a discipline for seeing wholes, a framework for seeing interrelationships rather than things. But, his systems thinking is not only characterized by seeing wholeness and interrelatedness of systems, but also , by seeing patterns of change. He regards systems thinking as a discipline for seeing the "structure" that underlie complex situations, and for discerning high from low leverage change. Because he thinks structure influences behavior, and structure in human systems is subtle. The reason that structural explanations are so important is that only they address the underlying causes of behavior at a level that patterns of behavior can be changes. Therefore, he claims that we need to look into the underlying structure of many organizational behaviors, not being confined within the incidents or patterns of behaviors. It is only when we see the systemic structure could we be collectively engaged in generative organizational learning, not responsive or reactive learning.

Another unique aspect of Senge's systems thinking is that Senge constructs systems thinking as a thinking language to be learned, practiced and cultivated. It is used to capture the structures underlying the individuals' or organizations' behavior structure. He develops 3 primary thinking tools for cultivating systems thinking: (1)feedback loop 1--reinforcing loops: when small changes become big changes, (2) feedback loop 2—balancing loops: pushing stability, resistance, and limits, and (3)delays: when things happen....eventually. In order to guide us to learn these thinking tools, he develops four toolboxes. They are (1) learning how to draw systems maps, including the interaction between cause and effect, its dynamic loop, system feedback perspectives, anti-agnosticism, and sharing systems problems, (2) learning how to describe reinforcing loops, (3) learning how to describe balancing loops, and (4) learn how to describe delays. Senge identifies the limitation of our written and spoken language, and thus tries to demonstrate to us how systems thinking can be represented through drawing systems maps, systems loops, nodes and time delay. He translates his long-term observation of and experience with recurrent organizational learning development and problems into "systems archetypes." Such systems archetypes are used to frame structural, and rooted problems of certain organizational behaviors or phenomenon. They are found in many organizations, include limits to growth, shifting the burden, eroding goals, escalation, success to the successful, tragedy of the commons, fixes that fail, and growth and underinvestment. In addition, he regards systems thinking as the fifth discipline which is the conceptual cornerstone underlying all of the five learning disciplines, team learning, shared vision, mental model, personal mastery and systems thinking itself. According to Senge, all of the five disciplines "are concerned with a shift of mind from seeing parts to seeing wholes, from seeing people as helpless reactors to seeing them as active participants in shaping their reality, from reacting to the present to creating the future. (p.69)." We should identify the fact that systems thinking has been successfully integrated to the teaching of many school subjects and many organizational learning-training programs. Its potential and value to education really needs further exploration.

Comparison of Banathy's and Senge's systems thinking

Generally speaking, Senge's systems thinking not only has Banathy's systemic view, but also has its unique features. From his profound systemic views, self and others are inseparable oneness. Therefore, the purpose of applying systems thinking is not to depict the details of the component systems, and the relationships among the major and minor systems. It is to frame and reframe our own problems by situating ourselves within the systems which we intend to understand and interpret. Meanwhile, his systems language translates complexity of reality into simplicity of wisdom, with which we could better identify the structural and rooted problems embedded in our own thinking and action. Systems archetypes become powerful tools for converting complicated problems or systems

into simple communicable language. In addition, Senge's systems thinking is intended to be practiced with other disciplines, personal mastery, mental models, team learning, and shared visions. All of the five disciplines cannot be cultivated in isolation. Through the mutual cultivation of the five disciplines, each discipline can exert its greatest learning impact on the team or organization. The five disciplines have been widely recognized and successfully practiced in many organizations. It is time for us to think about its value to education.

In the past decades, educational technologists' visions of systems thinking have been narrowed down to systematic ways of design. We should expand our thinking and discussion about the true nature of systems thinking, and allow more multiple perspectives on systems thinking to enrich our visions. We have focused too much on defining the outer educational systems, ignoring the inner systems within which most of us are prisoned. We may need to start thinking about how to bridge our inner thinking systems with the outer systems through Senge's cultivation of shared visions, team learning and reconstruction of mental models. It is significant to situate all learners, teachers and designers in the boundless circle of the educational systems. We should also learn to live with the fuzziness of system boundaries, which might have seriously distorted our perspectives of systems. If more and more designers could integrate the systems thinking proposed by Banathy and Senge into their practice, design will no longer be treated as models or theories to be applied. When the design community becomes more concerned about ways of expanding design visions and cultivating design thinking, design culture could be possibly fostered. Below is the comparison and synthesis of Senge's and Banathy's systems thinking.

Table 1: Comparison of Banathy's and Senge's systems thinking

The 1st generation Designer	• enters a system as an outside expert • creates an image of the future system • hands it over to the clients for implementation
The 2nd generation designer	• has slightly more interaction with clients • asks clients for feedback on the final draft before turning it over to them for implementation
The 3rd generation designer	• enters an organization as outside expert • draws up plans for the design or redesign of a system with even more interaction with clients. • invites input and feedback from the clients throughout the design process and may even assist them with the implementation.
The 4th generation designer	• takes a radically different role in the design process • functions primarily as a learning facilitator to help clients learn to design for themselves • shifts primary responsibility for learing and designing to the clients • shoulders responsibility for fostering participants' design competence • "does with" the clients, instead of "does to" or "does for" the clients

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Lookforward—the design-within approach

Indeed, no matter whether design is a problem-solving, problem-reframing, or dialogical process, we need to be aware if we are doing design in the mode of "reflection in action" or in our original habitual thinking, acting and ways of design. We also need to cultivate our critical awareness and understanding of the essence of design thinking and systems thinking. Especially when design in a team or organization, we need more space to allow one another to navigate so that design visions can be shared, and one's beliefs, values and mental models can be transformed through team learning. It is through the cultivation of design thinking and systems thinking in a learning team and organization that design culture could gradually be fostered. After reviewing and critiquing the essence of design thinking and systems thinking in the previous passages, I would like to propose a new approach of design—design WITHIN to elaborate on the possibilities of fostering a design culture. By taking the design-within approach, the user-designers could be engaged in the design process through which their thinking about design and systems are undergoing inner revolution. Such inner revolution will be dynamically interacting with the outer learning, instructional and educational transformation.

A design philosophy arises from inner revolution

To cultivate our inner revolution, we should hold a truly holistic, systemic view of their inner system and relate our inner systems with outer systems, and furthermore, resolving the boundary existing in between. Such systems thinking aims not at depicting individuals' and organizations' recurrent behavioral structure, but at integrating one's inner systems and outer learning and educational systems. Such systems thinking is to be cultivated through nurturing our inner systems which encompasses awareness, insights and visions. To nurture the growth of such inner system, we could take efforts through the following 3 tasks:

1. **Arousing our AWARENESS of**
   - our design thinking & action patterns/structures
   - personal and collective design thinking & action patterns/structures
   - the embedded causal links in our design thinking & action,
2. **Deepening our INSIGHTS of**
   - the multiple relationships of self, others, world and universe
   - the multiple relationships of cause and effect
   - complexity and uncertainties of human world
3. **Cultivating our VISIONS of**
   - integrating self with others through mutual growth
   - transcending personal limitation, & vicious causal links
   - tracing the pattern and strucure of problems

When engaged in building a design-within culture, the user-designers will not first define their design product or determine their design strategies. Instead, they will look inwardly through individual and collective reflection to nurture their systemic visions, insights, will and awareness of design. By doing so, uncovering one's design belief, value and philosophy would become the priority of design action. The design goals will shift from enhancing effectiveness and efficient to deepening design participants' visions, insights, will and awareness. In other words, the design-within approach identifies problems as those arising from one's inner systems which are intertwined with and inseparable from the problems we point outwardly to. The design-within approach is concerned with how our design might be influenced by our inner systems, and how we might reconceptualize our views of self and others, designers and users. When we view self and others, designers and users as oneness, we could approach design-within from a truly systemic spirit. Such systemic spirit would better engage us in crystallizing our ingrained design beliefs, values and philosophies. Through such crystallization, we could leap out from our habitual design thinking and action patterns.

Interconnectedness of inner and outer systems dynamics

Indeed, design-within is humanistic-based oriented toward one's inner realization, rather than product-based or goal-based. Design-within is an approach which extends from inner systems to outer learning systems, and arrows from the outer learning systems back to our inner systems. It focuses on the ongoing system dynamics among our inner systems, outer systems and inter-systems. It is through such inner-outer-inter systems dynamics that users and designers, or the so-called user-designers, might cultivate truly systemic thinking, and integrate with one another as an interconnected design community. If designers and users could collaborate with one another beyond the level of information and knowledge sharing, and engage themselves in such inner revolution and systems dynamics, transforming our design mindsets and the reality might be possible. While engaged in the design-within

process, users and designers probe their philosophy and values of design in reflective dialogue, and gradually cultivate their design-within thinking. Through such thought engagement, an interactive process from outward to inward, from inward to outward will be integrated. This might foster our design thinking and action with truly systemic spirit so as to take the responsibility for caring the whole, rather than improving parts of the system.

It is very likely that user-designers could leap out from the existing systems if their inner growth is taken into serious consideration. Because the design-within approach aims at collective and dialogical engagement of all participant's inner revolution. It focuses not on methods, tools, or models to create products, but on methods, tools and models to engage all participants in the systemic thinking process and in the inner revolution process. Its ultimate goal is to transform the existing inner and outer systems. I contend that when our design thinking is no longer locked in product-oriented design, we might foresee the magnificence of design art. The design-within approach is to explore the alternative design possibilities for transforming both inner and outer world. It is feedward from and feedback to the inner systems which are integrated with any outer systems we attempt to design.

The roles of designers in the design-within approach

Before elaborating on what roles the designers in the "WITHIN" approach might play, it is helpful to understand how Banathy compare the roles designers might play in different modes of design. The following table is a brief summary of Banathy's comparison of the evolutionary roles of designers.

The 1st generation Designer	• enters a system as an outside expert • creates an image of the future system • hands it over to the clients for implementation
The 2nd generation designer	• has slightly more interaction with clients • asks clients for feedback on the final draft before turning it over to them for implementation
The 3rd generation designer	• enters an organization as outside expert • draws up plans for the design or redesign of a system with even more interaction with clients. • invites input and feedback from the clients throughout the design process and may even assist them with the implementation.
The 4th generation designer	• takes a radically different role in the design process • functions primarily as a learning facilitator to help clients learn to design for themselves • shifts primary responsibility for learing and designing to the clients • shoulders responsibility for fostering participants' design competence • "does with" the clients, instead of "does to" or "does for" the clients

New roles of designers--Visioning designers

Compared to the four generations of design which focus on "design to", "design by", "design for", and "design with" respectively, the design-within approach places emphasis on all design participants' engagement in design "WITHIN". It is a thought-engagement and action-engagement process undertaken either individually or colllectively. Its systemic spirit builds on the integration of our inner systems into the outer systems, and the inter-systems. It is such holistic system dynamics that designers, users and all design participants are engaged in the design process as "visioning" teams or design communities, rather than "visible" teams or design communities. Through such visioning design teams or community, both inner revolution and societal revolution could be fostered. Designers of this approach share some similarities with the 4th generation designers. They also play as learning facilitators to help clients learn to design for themselves. While the responsibility they need to take is fostering participants' design competence, the responsibility for learning and designing is shifted to the clients. Despite these similarities, they would play other significant roles which the 4th generation designers may even be unaware of. Below are the different roles they would play:

- enters the design systems by treating themselves, other design participants and the social systems as "systemic oneness"
- cultivates all design participants' inner growth and mutual growth
- engages all design participants in reflective and critical thinking of their habitual thinking and action about design
- functions as learning enablers by transforming design into an inner and societal learning process
- shifts design focus from design product to design process to "design mind", a truly humanistic-based design

In one word, the design-within approach focuses on cultivating one's mind for design. It is truly systemic design in which learning and design comes to be oneness, everyone is working toward oneness of the whole system. Oneness becomes the philosophical foundation for constructing an integrated design team or community. Through such integration, design product and process can be greatly enriched and all participants' awareness, vision, insights and will of transforming reality by design can be nurtured and cultivated.

Conclusion

The knowledge base of instructional design models and theories encompasses behaviorism, neo-behaviorism, cognitivism, constructivism, situated theory, and even thinking from critical theory and postmodernism. It also integrates various views and concepts of learning, knowledge and systems thinking. Along with the evolution of design's knowledge base, the roles instructional designers play also change. When instructional designers work as an outside consultant, their role is to design for the users, working at best as the partners of subject matter experts, or the design experts of instructional materials or activities. When constructivism and situated learning gain more attention, instructional designers are expected to design with more comprehensive and timely understanding of the users' needs and feedback. They are also expected to create rich environments and situations for the users' learning, reflection and action (Streible, 1991). When embracing the critical paradigm of thinking, instructional designers' responsibility is to empower the learners' critical awareness of their own thinking and action so that learners are enabled to design their own learning (Li, 1993). In reviewing the evolutionary trend of instructional design, I found that different orientations of instructional design imply different design philosophies of and approaches to design. Although the previous research efforts have consolidated the knowledge base of instructional design to a certain degree, the essence of instructional design is yet to be fully explored. It is not until the early 1990s that the nature of design thinking and systems thinking receives more attention in the field of instructional technology; and more scholars share with the vision of transforming reality by design. As instructional designers, we need to leap out from our technical mode of thinking and acting. We need systemic change in the way we think and act about learning so as to foster our inner and social revolution. Most important of all, we need to cultivate strong willingness to redefine our roles as teachers, learners or designers. We should learn to be more responsible for our own learning, and resume the responsibility to design our own learning in the forthcoming learning world.

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